ST 800 & ST 700 SmartLine Transmitter

HART® Communications Options

Safety Manual

34-ST-25-37
Revision 4.0
July 2014

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Honeywell Process Solutions
1250 W Sam Houston Pkwy S
Houston, TX 77042

About This Document

Release Information

ST 800 & ST 700 SmartLine Transmitter HART® Communications Options Safety Manu**al # 34-ST-35-37.**

Revision	Date of Change	Details of Change
1.0	September, 2012	New
2.0	January, 2013	Updated to include ST 700
3.0	December, 2013	Link to Firmware downloads added, 316 SS
4.0	July, 2014	Test terminals for Non-SIL added

References

The following list identifies publications that may contain information relevant to the information in this document.

ST 800 & ST 700 SmartLine Pressure Transmitter Quick Start Installation Guide, 34-ST-25-36

ST 800 SmartLine Pressure Transmitter User Manual, Document # 34-ST-25-35

ST 800 SmartLine Pressure Transmitter HART/DE Option User's Manual, 34-ST-25-38

ST 800 FF Transmitter w/ FOUNDATION Fieldbus Option Installation & Device Ref Guide, 34-ST-25-39

ST 700 SmartLine Pressure Transmitter User Manual, 34-ST-25-44

ST 700 SmartLine Pressure Transmitter HART/DE Option User's Manual, 34-ST-25-47

ST 700 FF Transmitter w/ FOUNDATION Fieldbus Option Installation & Device Ref Guide, 34-ST-25-48

Patent Notice

The Honeywell ST 800 & ST 700 SmartLine Pressure Transmitter family is covered by one or more of the following U. S. Patents: 5,485,753; 5,811,690; 6,041,659; 6,055,633; 7,786,878; 8,073,098; and other patents pending.

Support and Contact Information

For Europe, Asia Pacific, North and South America contact details, refer to the back page of this manual or the appropriate Honeywell Solution Support web site:

Honeywell Corporate	www.honeywellprocess.com
Honeywell Process Solutions	www.honeywellprocess.com/pressure-transmitters/

Telephone and Email Contacts

Area	Organization	Phone Number
United States and Canada	Honeywell Inc.	1-800-343-0228 Customer Service 1-800-423-9883 Global Technical Support
Global Technical Support Field Product Sales	Honeywell Process Solutions	hfs-tac-support@honeywell.com FP-Sales-Apps@Honeywell.com

Terms and Abbreviations

1oo1	One out of one
Basic Safety	The equipment must be designed and manufactured such that it protects against risk of damage to persons by electrical shock and other hazards and against resulting fire and explosion. The protection must be effective under all conditions of the nominal operation and under single fault condition
DU	Dangerous Undetected failures
FMEDA	Failure Modes, Effects and Diagnostic Analysis
Functional Safety	The ability of a system to carry out the actions necessary to achieve or to maintain a defined safe state for the equipment / machinery / plant / apparatus under control of the system
GTS	Global Technical Support Center
HART®	Highway Addressable Remote Transmitter
HFT	Hardware Fault Tolerance
Low demand mode	Mode, where the frequency of demands for operation made on a safety-related system is no greater than one per year and no greater than twice the proof test frequency.
PFD_{AVG}	Average Probability of Failure on Demand
Safety	Freedom from unacceptable risk of harm
Safety Assessment	The investigation to arrive at a judgment - based on evidence - of the safety achieved by safety-related systems. Further definitions of terms used for safety techniques and measures and the description of safety related systems are given in IEC 61508-4.
SFF	Safe Failure Fraction, the fraction of the overall failure rate of a device that results in either a safe fault or a diagnosed unsafe fault.
SIF	Safety Instrumented Function, a set of equipment intended to reduce the risk due to a specific hazard (a safety loop).
SIL	Safety Integrity Level, discrete level (one out of a possible four) for specifying the safety integrity requirements of the safety functions to be allocated to the E/E/PE safety-related systems where Safety Integrity Level 4 has the highest level of safety integrity and Safety Integrity Level 1 has the lowest.
SIS	Safety Instrumented System – Implementation of one or more Safety Instrumented Functions. A SIS is composed of any combination of sensor(s), logic solver(s), and final element(s).

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1 — Requirements

Requirements for use of the manual

This section is intended for user's who have our ST 800 & ST 700 Smart Transmitter with the HART® Communication option with SIL. Any other option is not specifically covered by this manual.

IEC 61508 Ed. 2.0 compliant hardware/software revisions for the ST 800 & ST 700 can be found in the Exida and TÜV Certification Reports. In addition, the most recent release information can be found in the following document:

https://www.honeywellprocess.com/library/support/Public/Downloads/SmartLineHARTPressureFirmwareRevisions.zip

This document can be downloaded using the following link:

SmartLineHARTPressureFirmwareRevisions.zip

2 — Safety Function

Primary Safety Functions

The HONEYWELL ST 800 & ST 700 measures the (pressure gauge, differential, absolute) of a process and reports the measurement within a safety accuracy of 2%.

Secondary Safety Functions

The HONEYWELL ST 800 & ST 700 performs automatic diagnostics to detect internal failures and reports these failures via out of band signals on the 4 – 20 mA output. The transmitter needs power cycle for recovery from this condition.

Systematic Integrity: SIL 3 Capable

SIL 3 Capability:

The product has met manufacturer design process requirements of Safety Integrity Level (SIL) 3. These are intended to achieve sufficient integrity against systematic errors of design by the manufacturer. A Safety Instrumented Function (SIF) designed with this product must not be used at a SIL level higher than the statement without "prior use" justification by end user or diverse technology redundancy in the design. This is a Type B device.

3 — Designing with the HONEYWELL ST 800 & ST 700

Diagnostic Response Time

The HONEYWELL ST 800 & ST 700 will report an internal failure within 9 minutes of fault occurrence (worst case).

The transmitter will be put to burnout current if

1. PV is not updated in 5 seconds
2. Current is not as expected in 40 seconds
3. Electronics fault is found in 9 minutes

The transmitter needs power cycle for recovery from this condition.

Logic Solver Inputs

The logic solver must be configured so that the engineering range in the transmitter matches the expected range of the logic solver.

To take advantage of the internal diagnostics in the ST 800 & ST 700, the logic solver must be configured to annunciate an out of band current reading (greater than 20.8 mA. or less than 3.8 mA.) in standard configuration or (greater than 20.5 mA. or less than 3.8 mA.) with Namur configuration as a diagnostic fault. The logic solver configuration must consider the slew time of the current signal and ensure that filtering is used to prevent a false diagnostic failure annunciation.

Reliability data and lifetime limit

A detailed Failure Mode, Effects, and Diagnostics Analysis (FMEDA) report is available from HONEYWELL. This report details all failure rates and failure modes, common cause factors for applications with redundant devices and the expected lifetime of the HONEYWELL ST 800 & ST 700.

The HONEYWELL ST 800 & ST 700 is intended for low demand mode applications up to SIL 2 for use in a simplex (1oo1) configuration, depending on the PFD_{AVG} calculation of the entire Safety Instrumented Function. ST 800 & ST 700 is classified as type B device according to IEC61508, having a hardware fault tolerance of 0.

The development process of the HONEYWELL ST 800 & ST 700 is certified up to SIL3, allowing redundant use of the transmitter up to this Safety Integrity Level, depending the PFD_{AVG} calculation of the entire Safety Instrumented Function.

When using the HONEYWELL ST 800 & ST 700 in a redundant configuration, a common cause factor should be included in reliability calculations. For reliability calculation details, useful lifetime and SFF, see the FMEDA report.

The reliability data listed the FMEDA report is only valid for the useful life time of the HONEYWELL ST 800 & ST 700. The failure rates of the HONEYWELL ST 800 & ST 700 may increase sometime after this period. Reliability calculations based on the data listed in the FMEDA report for mission times beyond the lifetime may yield results that are too optimistic, i.e. the calculated Safety Integrity Level will not be achieved.

Environmental limits

The environmental limits of the HONEYWELL ST 800 & ST 700 are specified in the customer spec sheets as given in below table.

Model	Specification
STD8XX	34-ST-03-82
STG8XX	34-ST-03-83
STA8XX	34-ST-03-85
STF8XX	34-ST-03-87
STR8XX	34-ST-03-88
STA7XX	34-ST-03-100
STD7XX	34-ST-03-101
STG7XX	34-ST-03-102
STF7XX	34-ST-03-103
STR7XX	34-ST-03-104

Application limits

The application limits of the HONEYWELL ST 800 & ST 700 are specified in the User Manual. If the transmitter is used outside of the application limits the reliability data provided becomes invalid.

4 — Installation with the HONEYWELL ST 800 & ST 700

The person with knowledge of safety operations will be required to do the installation and operation. No special installation is required in addition to the standard installation practices outlined in the ST 800 & ST 700 Smart Transmitter User Manual. However please note that when the device is in safety operation the optional write protect must be set in hardware and software both so that the device is write protected and HART® devices must be disconnected. This can be done using the write protect jumper. See ST 800 & ST 700 Smart Transmitter User Manual for details concerning the write protect jumper.

The software write protect is also available in the device with a password to disable the software write protect. The default password is “0000”. It can be enabled / disabled through HART host.

IEC 61508 Ed. 2.0 compliant hardware/software revisions for the ST 800 & ST 700 can be found in the Exida and TÜV Certification Reports. In addition, the most recent release information can be found in the following document:
https://www.honeywellprocess.com/library/support/Public/Downloads/SmartLineHARTPressureFirmwareRevisions.zip

The Test (- +) terminals may be used during installation of the transmitter as a gross current loop check without disconnecting the current loop wiring. To use this feature, place a current meter with a low resistance (~10 ohm) across the TEST (- +) terminals. As shown in Figure 4-1.

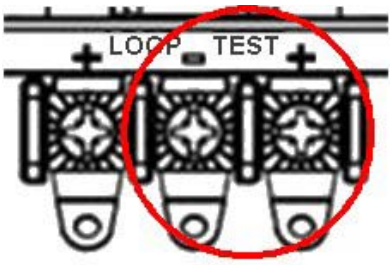

Figure 4-1

NOTE: During SIL operation, the TEST (- +) terminals should not be used to monitor the loop current.

Parameter settings

The following parameters need to be set in order to maintain the designed safety integrity:

mA Fault action (Upscale/Downscale)	The transmitter is shipped with a default failsafe direction of upscale (21.0 mA). This is acceptable for all high trip applications. For low trip applications, the fail-safe direction is downscale (3.6 mA.). A jumper on the transmitter may be changed to accomplish this action, see the User Manual.
Engineering Range	All engineering range parameters must be entered to match the trip points in the safety logic solver. These parameters must be verified during the installation and commissioning to ensure that the correct parameters are set in the transmitter. Engineering range parameters can be verified by reading these parameters from the local display or by checking actual calibration of the transmitter.

5 — Operation and Maintenance with the HONEYWELL ST 800 & ST 700

Proof test

The objective of proof testing is to detect failures within the HONEYWELL ST 800 & ST 700 that are not detected by the automatic diagnostics of the transmitter. Of main concern are undetected failures that prevent the safety instrumented function from performing its intended function.

The frequency of proof testing, or the proof test interval, is to be determined in reliability calculations for the safety instrumented functions for which the HONEYWELL ST 800 & ST 700 is applied. The Exida exSILentia® tool is recommended for these calculations. The proof tests must be performed more frequently than, or as frequently as specified in the calculation in order to maintain the required safety integrity of the safety instrumented function.

The following proof test is recommended. It consists of a simple HART® driven min to max output test. The results of the proof test need to be documented and this documentation should be part of a plant safety management system. Any failures that are detected and that compromise functional safety should be reported to the Global Technical Support Center (GTS).

See ST 800 & ST 700 Smart Transmitter User Manual for more details.

Step	Action
1	Bypass the safety PLC or take other appropriate action to avoid a false trip, following Management of Change procedures.
2	Send a HART® command to the transmitter to go to the high alarm current output and verify that the analog current reaches that value. This procedure tests for compliance voltage problems such as a low loop power supply voltage or increased wiring resistance. This also tests for other possible failures.
3	Send a HART® command to the transmitter to go to the low alarm current output and verify that the analog current reaches that value. This test checks for possible quiescent current related failures.
4	Use the HART® communicator to view detailed critical and non-critical device status to ensure no alarms or warnings are present in the transmitter.
5	Verify all safety critical configuration parameters.
6	The WP jumper state should be checked to see if it is in WP mode first, and then changed to Enable to ensure a change is detected by device while configuring, and then moved back to WP after the configuration is complete. Then it should be verified again.
7	Calibrate the device as per calibration procedure given below.
8	Restore the loop to full operation.
9	Remove the bypass from the safety PLC or otherwise restore normal operation.

This test will detect approximately 56% of possible DU failures in the transmitter (Proof Test Coverage). An alternative proof test consisting of proof test 1 with actual three point pressure calibration plus verification of the temperature measurement will detect approximately 99% of possible DU failures.

The person(s) performing the proof test of the HONEYWELL ST 800 & ST 700 should be trained in SIS operations, including bypass procedures, transmitter maintenance and company Management of Change procedures. Tools required are: handheld communicator.

Calibration procedure

The transmitter should be taken out of service. The source for the input pressure must be very precise, and certified for correct operation.

Step	Action
1	Connect the HART host and establish the communications.
2	Go to Online > Device Setup > Calibration > Calibration Methods menu.
3	Go to “D/A Trim”
4	Message “Warn loop should be removed from automatic control” will appear. Press “Ok”.
5	Message “Connect reference meter” will appear. Connect the reference meter and press “Ok”.
6	Message “Setting fld device output to 4mA” will appear. Press “Ok”. Message “Enter meter value (4,000mA)” will appear with a textbox to enter actual value observed on meter. Enter the actual value and press “Enter”.
7	Message “Fld dev output 4,000mA equal to reference meter?” will appear with Yes/No selection. Select “Yes” and “Enter”.
8	Message “Setting field device output to 20mA” will appear. Press “Ok”.
9	Message “Fld dev output 20,000mA equal to reference meter?” will appear with Yes/No selection. Select “Yes” and “Enter”.
10	Message “Returning fld dev to original output” will appear. Press “Ok”.
11	Now Double click “URV Correct” method
12	Message “WARN-Loop should be removed from automatic control” will appear. Press “Ok”.
13	Message “Please enter calibration date” will appear. Enter the current date and press “Ok”.
14	Message “Please enter current calibration time in 24 hr clock format (hour field)” will appear. Enter the current time hour and press “Ok”.
15	Message “please enter current calibration time (min field)” will appear. Enter the current time minutes and press “Ok”.
16	Message “Apply URV pressure” will appear.
17	Adjust the PV input to the required URV value. Press “Ok”.
18	Message “Press ok when pressure is stable” will appear. Press “Ok”
19	The correct URV operation will happen .
20	Message “Loop may be returned to automatic control” will appear. Press “Ok”.
21	Follow the same procedure for “Correct LRV” (replace URV in above procedure by LRV) and “Correct LRV” operation will get executed.

Repair and replacement

Any failures that are detected and that compromise functional safety should be reported to the Global Technical Support Center (GTS).
When replacing the HONEYWELL ST 800 & ST 700 the procedures in the installation manual should be followed.

FIRMWARE UPDATE

The user will not be required to perform any firmware updates. If the user has selected the firmware upgrade option, it can be done by Honeywell service representative.

Sales and Service

For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

ASIA PACIFIC

Honeywell Process Solutions,
(TAC) **hfs-tac-support@honeywell.com**

Australia
Honeywell Limited
Phone: +(61) 7-3846 1255
FAX: +(61) 7-3840 6481
Toll Free 1300-36-39-36
Toll Free Fax:
1300-36-04-70

China – PRC - Shanghai
Honeywell China Inc.
Phone: (86-21) 5257-4568
Fax: (86-21) 6237-2826

Singapore
Honeywell Pte Ltd.
Phone: +(65) 6580 3278
Fax: +(65) 6445-3033

South Korea
Honeywell Korea Co Ltd
Phone: +(822) 799 6114
Fax: +(822) 792 9015

EMEA

Honeywell Process Solutions,
Phone: + 80012026455 or
+44 (0)1344 656000

Email: (Sales)
FP-Sales-Apps@Honeywell.com
or
(TAC)
hfs-tac-support@honeywell.com

AMERICA'S

Honeywell Process Solutions,
Phone: (TAC) 1-800-423-9883 or
215/641-3610
(Sales) 1-800-343-0228

Email: (Sales)
FP-Sales-Apps@Honeywell.com
or
(TAC)
hfs-tac-support@honeywell.com

For more information
To learn more about SmartLine Transmitters,
visit **www.honeywellprocess.com**
Or contact your Honeywell Account Manager

Process Solutions
Honeywell
1250 W Sam Houston Pkwy S
Houston, TX 77042

Honeywell Control Systems Ltd
Honeywell House, Skimped Hill Lane
Bracknell, England, RG12 1EB

Shanghai City Centre, 100 Jungi Road
Shanghai, China 20061

www.honeywellprocess.com

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